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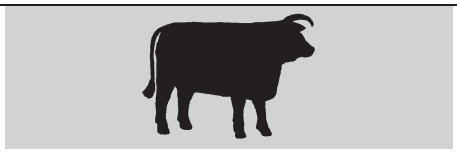

Effects of replacing soybean meal with pea chips and distillers dried grains with solubles in diets fed to growing-finishing pigs on growth performance, carcass quality, and pork palatability[1]

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ABSTRACT

Twenty-four growing pigs, 12 barrows and 12 gilts (initial BW of 23.18 ± 0.38 kg), were allotted to 1 of 3 dietary treatments. The control treatment group received corn–soybean meal diets during the growing, early finishing, and late finishing periods. The second treatment group received diets in which 50% of the soybean meal (SBM) was replaced with pea chips and distillers dried grains with solubles (DDGS), and the third treatment group received diets in which 100% of the SBM was replaced with pea chips and DDGS. Pigs were slaughtered at the end of the experiment; standard carcass measurements were collected for longissimus dorsi, gluteus medius, and serratus ventralis muscles. Pork chops were evaluated for tenderness, juiciness, and flavor. In the overall performance, ADFI was reduced (linear, P = 0.02) with pea chips and DDGS inclusion. End live weight (P = 0.04), HCW (P = 0.02), and belly firmness (P = 0.04) were also linearly reduced as field peas and DDGS replaced SBM in the diets. In the gluteus medius, 24-h pH was increased (quadratic, P = 0.05) when pigs were fed the 50% pea chips and DDGS inclusion diet. Percent cook loss, shear force, tenderness, and juiciness of the pork chops were not altered (P > 0.24); however, flavor decreased (linear, P = 0.05) as pea chips and DDGS replaced SBM in the diets. Diets containing the combination of pea chips and DDGS need to be less expensive than corn-SBM diets to be economical to feed to growing and finishing pigs.

Key words: carcass composition, distillers dried grains with solubles, palatability, pea chips, pork quality

INTRODUCTION

Distillers dried grains with solubles (**DDGS**) is produced in the Midwest, and effects on growth performance of growing-finishing pigs fed DDGS have been reported (Whitney et al., 2006; Linneen et al., 2008). Effects of DDGS on carcass quality and pork palatability have also been reported (Widmer et al., 2008). Based on this research, it has been concluded that DDGS may be included in diets fed to growing-finishing pigs at concentrations of up to 20% (Stein and Shurson, 2009).

North Dakota is the largest producer of field peas in the United States (NASS, 2011). A large proportion of field peas are split and used for

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human consumption, but during this process, a coproduct called pea chips is produced (Newman et al., 2011). Pea chips consist of peas that are crushed during the splitting process, and pea chips may replace all of the soybean meal (**SBM**) in diets fed to growing-finishing pigs without negatively influencing pig performance (Newman et al., 2011).

Pea protein has a relatively high concentration of lysine and a low concentration of methionine and cysteine (Stein et al., 2004), whereas the protein in DDGS has a relatively low concentration of lysine but a high concentration of methionine and cysteine. The 2 protein sources, therefore, may complement each other, but there are no reports on the effects of feeding a combination of field peas and DDGS to growing-finishing pigs. The objective of this experiment was, therefore, to evaluate the effects of replacing SBM with a combination of field peas and DDGS in diets fed to growing-finishing pigs on pig growth performance, carcass quality, and the palatability of pork chops.

MATERIALS AND METHODS

Animal Growth Performance

The protocol for this experiment was reviewed and approved by the Institutional Animal Care and Use Committee at North Dakota State University. Twenty-four growing pigs, 12 gilts and 12 barrows, were used in the experiment. Pigs (initial BW of 23.18 ± 0.38 kg) were the offspring of Hampshire × Duroc boars that were mated to Landrace × Yorkshire females. Pigs were blocked by sex and initial BW and randomly assigned to 1 of 3 treatment groups with 8 replicate pigs, 4 gilts and 4 barrows, per treatment group. Pigs were housed individually in 0.89 × 1.47 m pens in an environmentally controlled group with a 14-h-light and 10-h-dark cycle. Pens had fully slatted plastic floors, a one-hole feeder, and a nipple drinker.

Table 1. Analyzed nutrient composition of pea chips, distillers dried grains with solubles (DDGS), corn, and soybean meal (as-fed basis)

Nutrient, %	Pea chips	DDGS	Corn	Soybean meal
DM	91.20	91.27	89.21	90.61
CP	23.40	28.12	8.51	49.57
ADF	6.77	10.39	1.53	3.62
NDF	7.23	34.80	7.31	7.33
Calcium	0.10	—	0.01	0.44
Phosphorus	0.43	1.09	0.32	0.66
Indispensable amino acids				
Arginine	2.08	1.15	0.36	3.30
Histidine	0.57	0.79	0.22	1.21
Isoleucine	0.92	0.96	0.28	2.05
Leucine	1.63	3.03	0.91	3.55
Lysine	1.67	0.96	0.25	2.93
Methionine	0.25	0.54	0.17	0.65
Phenylalanine	1.08	1.16	0.37	3.31
Threonine	0.88	0.99	0.26	1.77
Tryptophan	0.20	0.20	0.07	0.71
Valine	1.04	1.34	0.38	2.15
Dispensable amino acids				
Alanine	1.02	1.89	0.56	1.97
Asparagine	2.67	1.64	0.50	5.21
Cysteine	0.37	0.57	0.16	0.66
Glutamine	3.97	3.77	1.37	8.04
Glycine	1.03	1.05	0.31	1.92
Proline	1.07	2.20	0.64	2.14
Serine	1.14	1.15	0.30	2.01
Tyrosine	—	0.93	0.24	1.71

Chemical Analysis

Samples of pea chips, DDGS, corn, SBM, and all diets were analyzed in duplicate (Table 1) for DM (method 930.15; AOAC, 2007), CP (method 990.03; AOAC, 2007), ADF (method 973.18; AOAC, 2007), and NDF (Holst, 1973). Amino acids were analyzed on a Hitachi Amino Acid Analyzer, Model No. L8800 (Hitachi High Technologies America Inc., Pleasanton, CA) using ninhydrin for postcolumn derivatization and norleucine as the internal standard. Before analysis, samples were hydrolyzed with 6 *N* HCl for 24 h at 110°C (method 982.30 E(a); AOAC, 2007). Methionine and cysteine were determined as methionine sulfone and cysteic acid after cold performic acid oxidation overnight before hydrolysis (method 982.30 E(b); AOAC, 2007). Tryptophan was determined after NaOH hydrolysis for 22 h at 110°C (method 982.30 E(c); AOAC, 2007). Diets and ingredients were also analyzed for calcium and phosphorus by inductively coupled plasma spectroscopy (method 985.01; AOAC, 2007) after wet ash sample preparation (method 975.03; AOAC, 2007), and diets were analyzed for ash (method 942.05; AOAC, 2007). Pea chips (Dakota Dry Bean Inc., Crary, ND) and Dakota Gold DDGS (Poet Nutrition, Sioux Falls, SD) were procured, and corn and SBM were sourced locally. The same batch of each feed ingredient was used in all diets throughout the experiment.

Pigs were fed growing diets until they were approximately 60 kg, early finisher diets until they were approximately 90 kg, and late finisher diets until the conclusion of the experiment when pigs had an average BW of 123.5 ± 2.37 kg. Three diets were formulated within each phase (Tables 2 and 3). The control diet in each phase was based on corn and SBM and contained 28.0, 21.4, and 16.2% SBM in the growing, early finishing, and late finishing diets, respectively.